

**Patent Claims**

1. Nucleic acids which encode polypeptides from tobacco with the bioactivity of a zeta-carotene desaturase, which comprises the amino acid sequence of SEQ ID NO: 6.
2. Nucleic acids according to Claim 1, characterized in that they encode polypeptides with the amino acid sequence of SEQ ID NO: 6.
3. Nucleic acids according to Claim 1 or 2, characterized in that they are single-stranded or double-stranded DNA or RNA.
4. Nucleic acids according to Claim 3, characterized in that they are fragments of genomic DNA or cDNA.
5. Nucleic acids according to one of Claims 1 to 4, characterized in that they are derived from tobacco plants.
6. Nucleic acids according to one of Claims 1 to 5, comprising a sequence selected from amongst
- (a) the sequence of SEQ ID NO: 5,
  - (b) sequences encoding a polypeptide which comprises the amino acid sequence of SEQ ID NO: 6,
  - (c) part sequences of the sequences defined under (a) or (b) which are at least 14 base pairs in length,
  - (d) sequences which hybridize with the sequences defined under (a), (b) or (c),
  - (e) sequences which are complementary to the sequences defined under (a), (b) or (c), and

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(f) sequences which, owing to the degeneracy of the genetic code, encode the same amino acid sequence as the sequences defined under (a) to (c).

5 7. Regulatory region which naturally controls, in plant cells, in particular in tobacco plants, the transcription of a nucleic acid according to one of Claims 1 to 6.

10 8. DNA construct comprising a nucleic acid according to one of Claims 1 to 6 and a heterologous promoter.

15 9. Vector comprising a nucleic acid according to one of Claims 1 to 6, a regulatory region according to Claim 7 or a DNA construct according to Claim 8.

20 10. Vector according to Claim 9, characterized in that the nucleic acid is linked functionally to regulatory sequences which ensure the expression of the nucleic acid in pro- or eukaryotic cells.

25 11. Host cell containing a nucleic acid according to one of Claims 1 to 6, a DNA construct according to Claim 8 or a vector according to Claim 9 or 10.

30 12. Host cell according to claim 11, characterized in that it is a prokaryotic cell, in particular *E. Coli*.

35 13. Host cell according to Claim 11, characterized in that it is a eukaryotic cell, in particular a yeast cell, insect cell, mammalian cell or plant cell.

40 14. Polypeptide with the bioactivity of a phytoene synthase which is encoded by a nucleic acid of SEQ ID NO: 1 or SEQ ID NO: 3, comprising an amino acid sequence of SEQ ID NO: 2 or SEQ ID NO: 4.

45 15. Polypeptide with the bioactivity of a zeta-carotene desaturase which is encoded by a nucleic acid according to one of Claims 1 to 6.

50 16. Antibody which binds specifically to a polypeptide of Claim 14.

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17. Antibody which binds specifically to a polypeptide of Claim 15.
18. Process for generating a nucleic acid according to one of Claims 1 to 6,  
comprising the following steps:
- (a) complete chemical synthesis carried out in a manner known per se or
  - (b) chemical synthesis of oligonucleotides, labelling the oligonucleotides, hybridizing the oligonucleotides with DNA of a genomic or cDNA library which has been generated starting from genomic DNA or mRNA of plant cells, selection of positive clones and isolation of the hybridizing DNA from positive clones, or
  - (c) chemical synthesis of oligonucleotides and amplification of the target DNA by means of PCR.
19. Process for generating a polypeptide according to Claim 14 or 15, comprising
- (a) culturing a host cell according to one of Claims 11 to 13 under conditions which ensure the expression of the nucleic acid according to one of Claims 1 to 6, or
  - (b) expressing a nucleic acid according to one of Claims 1 to 6 in an *in-vitro* system, and
  - (c) obtaining the polypeptide from the cell, the culture medium or the *in-vitro* system.
20. Method of finding a chemical compound which binds to a polypeptide according to Claim 14 and/or 15 or a polypeptide with the bioactivity of a phytoene desaturase, comprising the following steps:
- (a) contacting a host cell according to one of Claims 11 to 13, a polypeptide according to Claim 14 or 15 or a polypeptide with the bioactivity of a phytoene desaturase with a chemical compound or a

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mixture of chemical compounds under conditions which permit the interaction of a chemical compound with the polypeptide, and

- (b) determining the chemical compound which binds specifically to the polypeptide.

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21. Method of finding a compound which modifies the expression of polypeptides according to Claim 14 or 15 or a polypeptide with the bioactivity of a phytoene desaturase, comprising the following steps:

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- (a) contacting a host cell according to one of Claims 11 to 13 with a chemical compound or a mixture of chemical compounds,
- (b) determining the polypeptide concentration, and
- (c) determining the compound which specifically influences the expression of the polypeptide.

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22. Use of a nucleic acid according to one of Claims 1 to 6, of a DNA construct according to Claim 8, of a vector according to Claim 9 or 10, of a host cell according to one of Claims 11 to 13, of a polypeptide according to Claim 14 or 15 or of a polypeptide with the bioactivity of a phytoene desaturase or of an antibody according to Claim 16 or 17 for finding new herbicidal active substances.

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23. Use of a modulator of a polypeptide according to Claim 14 or 15 or of a polypeptide with the bioactivity of a phytoene desaturase as plant growth regulator or herbicide.

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24. Use of a nucleic acid according to one of Claims 1 to 6, of a DNA construct according to Claim 8 or a vector according to Claim 9 or 10 for generating transgenic plants.

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25. Transgenic plants, parts of plants, protoplasts, plant tissues or plant propagation materials, characterized in that the intracellular concentration of a polypeptide according to Claim 16 or 17 is increased or reduced in

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comparison with the corresponding wild-type cells after introducing a nucleic acid according to one of Claims 1 to 6, a DNA construct according to Claim 8 or a vector according to Claim 9.

- 5 26. Plants, parts of plants, protoplasts, plant tissues or plant propagation materials, characterized in that they contain a polypeptide according to Claim 14 or 15 whose bioactivity or expression pattern is modified in comparison with the corresponding endogenous polypeptides.

- 10 27. Method of generating plants, parts of plants, protoplasts, plant tissues or plant propagation materials according to Claim 25, characterized in that a nucleic acid according to one of Claims 1 to 6 or a regulatory region according to Claim 7 is modified by endogenous mutagenesis.

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